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OCEAN ACRE 11: A REPORT OF THE CRUISE WITH SOME PRELIMINARY OBS--ETC(U)  
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NAVAL UNDERWATER SYSTEMS CENTER  
NEWPORT, RHODE ISLAND 02840

OCEAN ACRE 11:  
A REPORT OF THE CRUISE  
WITH SOME PRELIMINARY OBSERVATIONS.

By

Charles L. Brown

Technical Memorandum TA131-44-71

6 April 1971

INTRODUCTION

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The eleventh Ocean Acre Cruise occurred between 9-22 January 1971, aboard USNS SANDS (T-AGOR-6). The objectives of the cruise were to: continue seasonal collections of biological organisms throughout the water column to a depth of 1500 meters, take measurements of scattering strengths of the water column at three frequencies (3.85, 13.5 and 15.5 kHz), and take associated hydrographical data. The information obtained is part of the Ocean Acre program designed to investigate the acoustics and biology of volume reverberation, (NUSL Publication No. 1107).

#### ADMINISTRATIVE INFORMATION

This memorandum was prepared under Naval Underwater Systems Center/New London Laboratory Project title, Biological Oceanography as it affects ASW Operations, C. L. Brown, Naval Underwater Systems Center/New London Laboratory Principal Investigator. The sponsoring activity was NAVSHIPS, B. K. Couper, Program Manager.

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Participating Personnel:

1. Charles L. Brown, Project Leader, NUSC/NL
2. Albert L. Brooks, Biologist, NUSC/NL
3. David F. Giuliano, Biologist, NUSC/NL
4. Ralph T. Austin, Electrical Engineer, NUSC/NL
5. George Battista, Electrical Engineer, NUSC/NL
6. William J. Stacknik, Physicist, NUSC/NL
7. Frank Wyatt, Oceanographic Technician, NUSC/NL
8. Michael J. Keene, Biologist, Smithsonian Institution
9. Ronald Gatton, Biologist, Smithsonian Institution
10. Charles Karnella, Biologist, Smithsonian Institution
11. George Bond, Biologist, University of Rhode Island
12. John Greene, Biologist, University of Rhode Island
13. Kenneth Tighe, Biologist, University of Rhode Island
14. Gilbert L. Chase, Biologist, University of New Hampshire
15. John F. Crotty, Ships Co-ordinator, NUSC/NL

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Point and Time of Departure:

Yorktown, Virginia, 9 January 1971, 1500 hrs.

Point and Time of Arrival:

Bermuda, 17 January 1971, 1100 hrs.

Principal Equipment Employed:

10 ft. Isaacs-Kidd Midwater Trawl equipped with a four chambered discrete-depth codend; hull mounted 3.5 kHz dome transducer; towable transducer operating at 13.5 and 15.5 kHz; Giff Precision Graphic Recorder; Time-depth recorder, photometers.

METHODS

Biological tows were taken for three hours at selected depths, day and night. The last chamber was used for an oblique haul from depths to the surface. The gates of the chamber were opened and closed on deck electrically by means of a reed relay system. In addition, a pressure gauge on the net was monitored on deck to provide tow depth information. Plotted against TDR records however, it was observed that the pressure gauge was not operating adequately. A one meter-net was used to collect neuston samples.

Vertical profiles of scattering strengths at three frequencies were taken at selected intervals under silent ship conditions. The 3.85 kHz measurements were taken using the dome. The 13.5 and 15.5 kHz data were taken by lowering the tow body over the side to a depth of approximately 10 meters. Reverberation data was recorded on magnetic tape for later analysis at Naval Underwater Systems Center/ New London Laboratory. Echograms were made intermittently at 3.85 kHz.

Temperature profiles were taken with 2500' and 6000' XBT's. A Nansen Cast was made to 2000m and the temperature and salinities determined aboard ship.

#### RESULTS AND DISCUSSION

The ship arrived at the Ocean Acre site on 12 Jan. and the acoustic gear was calibrated. Biological towing began at 1300 (local time). When the net was retrieved examination of the new electric swivel revealed that a leak had developed about the O-ring. These were replaced and for trawls 2-6 no difficulties were encountered.

When the swivel repair was in progress, acoustic calibrations were conducted. Following that a standard Nansen Cast was taken to 2000m. The data is shown in Table I.

Trawl 6 was aborted because the on deck controls revealed a malfunction in the system. Upon retrieval it was found that the new swivel had been machined to to close a tolerance and was binding. The unit was replaced with a back-up. Only minor difficulties were encountered for the remaining trawls, 7-13.

In all, 12 trawls were successfully completed yielding 32 discrete samples. One dip net station was conducted and 8 neuston tows were made. Table II gives the date, time of day and position of the trawls. Table III shows, the relative time, depth and trawl number.

Of special interest was the catch from Trawl 4, fished for three hours between 600 and 689m. Sample A fished for one hour at a depth of 680m, sample B, one hour at 640m, while sample C fished for one hour at 600m. cursory examination of the samples revealed substantial differences in total abundance among the three samples, although the composition appeared quite similar among the three. Sample C had about twice the amount of material than sample A, while sample B had about one and a half times as much as A. These large differences in abundance over a relatively small depth range (80m) indicate a fine layering of animals, that is not otherwise revealed when sampling 100m



increments. The significance of this to acoustics awaits analysis of the data to see if different types of animals actually were present over the depths, and if the vertical scattering strength profiles reveal such a layering.

Acoustic measurements usually lasted for about 1-2 hours and were taken during non-migratory periods. Table IV is a log of acoustic measurements. Most data was taken at 3.85 kHz, because the 13.5 and 15.5 kHz transducer was noisy. No migration period data were taken.

TABLE IV

## Date and Time of Acoustic Measurements

<u>Jan. 1971</u>	<u>Mid-day</u>	<u>Mid-night</u>
12		X
13	X	X
14	X	X
15	X	X

FGR echograms made at 3.85 kHz day and night showed, again as in ACRE-10, hyperbolae or "tent" type echoes. This suggests that organisms near the illuminating frequency are present in the water column at selected depths (about 200m) throughout the day. Biological analysis, hopefully will describe what animals are responsible for the "tent" echoes.

For the first time during the Ocean Ocre program off Bermuda, light measurements were taken in relationship to the migratory behavior of the DSL. This data has been reported on.<sup>1</sup>

In addition to the Nansen Cast (Table 1), 8, 750m (2500') XBT's and 2, 1830m (6000') XBT's were taken. The XBT log is given in Table V.

1. Stachnik, William J., "Estimations of Ambient Light Levels within the Acoustical Deep Scattering Layer," Naval Underwater Systems Center/ New London Technical Memorandum No. SA3-3-71 of 22 February 1971

TABLE V

## XBT Log

<u>Jan. 1971</u>	<u>No.</u>	<u>Time</u>	<u>Depth(m)</u>	<u>Position</u>
10	1	1230	730	Enroute
12	2	1215	730	32°00'N 64°03'W
13	3	0001	730	31°48'N 63°48'W
13	4	1220	730	31°39'N 64°09'W
13	5	2340	730	31°58'N 64°21'W
14	6	1230	730	31°59'N 62°50.8'W
14	7	2400	730	31°58'N 62°47'W
15	8	1110	900	31°32'N 62°58'W
15	9	1200	1830	31°34'N 63°08'W
15	10	2340	1830	32°04'N 63°12'W

On the 15th of January high winds resulting in high seas forced the stopping of all sampling operations. The adverse weather continued and USNS SANDS put into Bermuda (NOB) on 17 Jan. The high winds and seas continued until 22 Jan. when Acre 11 was cancelled.

## SUMMARY

Acre 11 was the first Acre Cruise that obtained acoustic and discrete biological samples in a winter period. Further, for the first time ambient light values were correlated with the DSL migrations. Unfortunately, bad weather curtailed sampling, so that another winter, sampling period is necessary. An Ocean Acre Cruise is scheduled for December 1971.

*C. L. Brown, Jr.*  
C. L. BROWN, JR.

TABLE I

Hydrographic Cast - Ocean Acre 11

12 Jan 71 - 31°51'N - 063°52'W

Time-Start 1810 - Time-End 2115

<u>Corrected Depth (M)</u>	<u>Corrected Temp. (°C)</u>	<u>Salinity (°/00)</u>
0	20.40	36.515
10	20.07	36.526
25	20.05	36.526
50	20.06	36.526
75	20.02	36.519
88	20.04	36.547
177	19.39	36.511
353	17.48	36.429
530	16.48	36.287
706	13.65	35.717
883	9.31	35.211
1324	5.08	34.993
1766	4.21	34.961

TABLE II

## Acre 11 - Trawl Log

Jan. 1971 Day	Trawl No.	Time (Local) Set-Retrieve	Position Start-Finish	Ship Speed
12	1	1307-1655	31°57'N-064°05'W 31°51'N-063°48'W	4
12-13	2	2300-0245	31°51'N-063°48'W 31°40'N-063°48'W	4
13	3	0315-0640	31°41'N-063°47'W 31°40'N-063°54'W	3
13	4	0712-1223	31°40'N-063°54'W 31°38'N-064°11'W	3
13	5	1340-1800	31°39'N-064°12'W 31°48'N-064°17'W	3
13	6	Aborted		
13-14	7	2141-0020	31°54'N-064°18'W 31°58'N-064°22'W	3
14	8	1535-1915	32°03'N-062°58'W 32°10'N-062°49'W	3
14-15	9	1940-0045	32°10'N-062°49'W 31°58'N-062°47'W	3
15	10	0140-0518	31°57'N-062°48'W 31°49'N-062°50'W	3
15	11	0545-0930	31°48'N-062°51'W 31°38'N-062°54'W	3
15	12	1002-1220	31°58'N-062°51'W 31°54'N-063°02'W	3
15	13	1340-1850	31°36'N-063°04'W	3



TABLE III

Time of Day, Depth and Sample No.

Depth (M)	Day 0715-1710	Evening Migration 1710-1910	Night 1910-0515	Morning Migration 0515-0715
50	12A,B		2A,B,C	
100			3A,B,C	
150	11C	8B,C		11A,B
200	8A		10A,B,C	
250				
300	5A,B			
400				
500	1A,B,C			
600	4A,B,C		7A,B	
700	13A,B			13C
800			9A,B,C	